Perspective

Sanitation Systems (/perspective/sanitation-systems-perspective)

Section

Sanitation Technologies (/sanitation-systems/sanitation-technologies)

Factsheet

Human-powered Emptying and Transport

العربية (/ar/sanitation-systems/sanitation-technologies/human-powered-emptying-and-transport)

Applicable to

System 1 (/humanitarian-crises/rural-settings/sanitation/sanitation-systems/system-1%3A-single-pit-system)
System 2 (/humanitarian-crises/rural-settings/sanitation/sanitation-systems/system-2%3A-waterless-pit-system-without-sludge-production)
System 3 (/humanitarian-crises/rural-settings/sanitation/sanitation-systems/system-3%3A-pour-flush-pit-system-without-sludge-production)
System 4 (/sanitation-systems/sanitation-systems/system-4%3A-waterless-system-with-urine-diversion)
System 6 (/humanitarian-crises

Application level

- City
- Household
- Neighborhood

Management level

- Household
- Public
- Shared

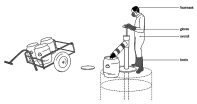
Inputs

Dried Faeces, Compost, Pit Humus, Sludge

Outputs

Dried Faeces, Compost, Pit Humus, Sludge

/rural-settings
/sanitation/sanitation-
systems/system-
6%3A-blackwater-
treatment-system-
with-infiltration)
System 7
(/humanitarian-crises
/rural-settings
/sanitation/sanitation-
systems/system-
7%3A-blackwater-
treatment-system-
with-effluent-transport)



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Adapted from

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Executive Summary

Human-powered emptying and transport refers to the different ways in which people can manually empty and/or transport sludge and solid products generated in on-site sanitation facilities.

Advantages

- Potential for local jobs and income generation
- Simple hand pumps can be built and repaired with locally available materials
- Low capital costs; variable operating costs depending on transport distance
- Provides services to areas/communities without sewers

Disadvantages

- Spills can happen which could pose potential health risks and generate offensive smells
- Time consuming: emptying pits out can take several hours/days depending on their size
- Garbage in pits may block pipe
- Some devices may require specialized repair (welding)

In	Out

In	Out
Faecal Sludge, Faeces, Excreta, Organic Solid Waste, Compost/Biosolids	Faecal Sludge, Faeces, Excreta, Organic Solid Waste, Compost/Biosolids

Introduction

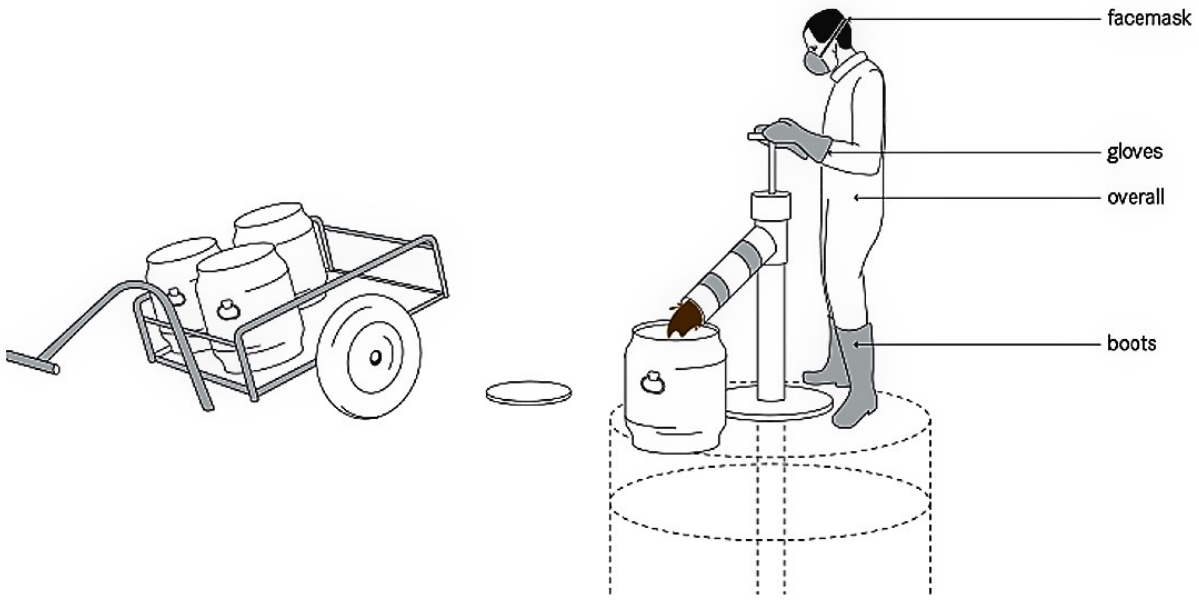
Human-powered emptying of pits, vaults and tanks can be done in one of two ways:

- using buckets and shovels, or
- using a portable, manually operated pump specially designed for sludge (e.g., the Gulper, the Rammer, the MDHP or the MAPET).

Some sanitation technologies can only be emptied manually, for example, the **fossa alterna (/humanitarian-crises/urban-settings/planning-process-tools/implementation-tools/fossa-alterna)**or **dehydration vaults (/humanitarian-crises/prolonged-encampments/sanitation/collection-and-storage-treatment/dehydration-and-storage)**. These technologies must be emptied with a shovel because the material is solid and cannot be removed with a vacuum or a pump (e.g. the **fossa alterna (/humanitarian-crises/urban-settings/planning-process-tools/implementation-tools/fossa-alterna)**, **aroborloo (/factsheet/arborloo)**, **composting toilets (/factsheet/composting-chamber)** or **UDDTs (/taxonomy/term/2660/uddt)**).

When sludge is viscous or watery it should be emptied with a hand pump, a MAPET or a vacuum truck, and not with buckets because of the high risk of collapsing pits, toxic fumes, and exposure to unsanitised sludge.

Manual sludge pumps are relatively new inventions and have shown promise as being low-cost, effective solutions for sludge emptying where, because of access, safety or economics, other emptying techniques are not possible.



Schematic of human-powered emptying and transport. Source: TILLEY et al. 2014

Design considerations

Sludge hand pumps work on the same concept as water hand pumps: the bottom of the pipe is lowered into the pit/tank while the operator remains at the surface. As the operator pushes and pulls the handle, the sludge is pumped up and is then discharged through the discharge spout. The sludge can be collected in barrels, bags or carts, and removed from the site with little danger to the operator. Hand pumps can be locally made with steel rods and valves in a PVC casing.

A MAPET (MAnual Pit Emptying Technology) consists of a manually operated pump connected to a vacuum tank mounted on a pushcart. A hose is connected to the tank and is used to suck sludge from the pit. When the hand pump is turned, air is sucked out of the vacuum tank and sludge is sucked up into the tank. Depending on the consistency of the sludge, the MAPET can pump up to a height of 3 m.

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Health aspects/acceptance

Depending on cultural factors and political support, workers dealing with manual emptying may be viewed as providing an important service to the community. Government-run programmes should strive to legitimize the work of the labourer and provide an enabling environment by providing permits and licences, as well as helping to legalize the practice of emptying latrines manually.

The most important aspect of manual emptying is ensuring that workers are adequately protected with gloves, boots, overalls and facemasks. Regular medical exams and vaccinations should be required for everyone working with sludge.

Operation & maintenance

It is a common practice to add chemicals or oil during the pit emptying process to avoid odours. This is not recommended, however, because it causes difficulties in the subsequent treatment units, as well as additional health threats to the workers.

If manual access to the contents of a pit requires demolishing the slab, it may be more cost-effective to use a

manual sludge pump to empty the latrine. However, hand pumps cannot empty the entire pit and, therefore, emptying may be required more frequently (once a year).

Manually operated sludge pumps require daily maintenance (cleaning, repairing and disinfection). Workers who manually empty latrines should clean and maintain their protective clothing and tools to prevent contact with the sludge.

Applicability

Hand pumps can be used for liquid and, to a certain degree, viscous sludge. Domestic refuse in the pit makes emptying much more difficult. The pumping of sludge, which contains coarse solid wastes or grease, can lead to clogging of the device, and chemical additives can corrode pipes, pumps and tanks. The hand pump is a significant improvement over the bucket method and could prove to be a sustainable business opportunity in some regions.

Manually operated sludge pumps are appropriate for areas that are not served or not accessible by vacuum trucks, or where vacuum truck emptying i too costly. They are well suited to dense, urban and informal settlements, although the type and size of transport vehicle determines the feasible distance to the discharge point. Large vehicles may not be able to manoeuvre within narrow streets and alleys, while smaller vehicles may not be able to travel long distances. These technologies are more feasible when there is a **transfer station (/sswm-university-course/module-2-centralised-and-decentralised-systems-water-and-sanitation/further/transfer-and-sewer-discharge-stations)** nearby.

Library References

Bringing pit emptying out of the darkness

This paper is one of a series that look sanitation partnerships in poor urban communities, that questions when and why partnership may be appropriate or inappropriate to the delivery of on-site sanitation services. It is a comparison of two manual emptying projects.

EALES, K. (2005): Bringing pit emptying out of the darkness. A comparison of approaches in Durban, South Africa, and Kibera, Kenya. United Kingdom: Building Partnerships for Development in Water and Sanitation **URL (http://www.bpdws.org/web/d/doc_131.pdf?statsHandlerDone=1)** [Accessed: 21.10.2013]

The Gulper – a manual latrine/drain pit pump

This short document describes the functioning of the gulper technology to empty pit latrines or septic tanks.

IaW (2007): The Gulper – a manual latrine/drain pit pump. Phnom Penh/Casteren: Ideas at Work (IaW) **URL (https://www.pseau.org/outils/ouvrages/iaw_ideas_at_work_the_gulper_2007.pdf)** [Accessed: 28.05.2019]

MAPET. A neighbourhood based pit emptying service with locally manufactured hand pump equipment in Dar es Salaam, Tanzania

This document is the final report of the MAPET project in Dar es Salaam, Tanzania. Project objectives were to contribute to the improvement of environmental sanitation in unplanned areas by facilitating an effective and hygienic pit emptying services, and to improve the informal traditional pit emptying method by making it more efficient and hygienic.

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This paper introduces manual desludging hand pump. The design, its use and maintenance is illustrated with many images.

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Emptying Pit Latrines

This technical brief describes several possibilities of emptying pit latrines and helps to find the most suitable method.

PICKFORD, J. SHAW, R. (1997): Emptying Pit Latrines. (= Technical Briefs, No. 54). Loughborough: Water and Environmental health at London and Loughborough (WELL) **URL (https://www.ircwash.org/resources/technical-brief-no-54-emptying-latrine-pits)** [Accessed: 28.05.2019]